IN THE CLAIMS

Please amend the claims as follows:

Claim 1 (Currently Amended): A method of facilitating a process performed by a semiconductor processing tool, comprising:

~~inputting process data relating to an actual process being performed by the semiconductor processing tool;~~

~~inputting a first principles physical model including a set of computer-encoded differential equations, the first principles physical model describing at least one of a basic physical or chemical attribute of the semiconductor processing tool;~~

~~performing first principles simulation for the actual process being performed during performance of the actual process using the physical model to provide a virtual sensor measurement in accordance with the process data relating to the actual process being performed in order to simulate the actual process being performed, said first principles simulation result being produced in a time frame shorter in time than the actual process being performed;~~

inputting a first principles physical model including a set of computer-encoded differential equations, the first principles physical model describing at least one of a basic physical or chemical attribute of the semiconductor processing tool and including 1) a spatially resolved model of a physical geometry of the semiconductor processing tool and 2) a grid set addressing the semiconductor processing tool or a geometry of the semiconductor processing tool;

inputting process data related to an actual process being performed by the semiconductor processing tool;

setting boundary conditions for the spatially resolved model of a physical geometry of the semiconductor processing tool based on said process data related to the actual process being performed by the semiconductor processing tool;

storing in a fab-level library known simulation results obtained from simulation modules in a device manufacturing fab and distributing the known simulation results to other semiconductor processing tools in the device manufacturing fab;

solving the computer-encoded differential equations of the first principles physical model for the spatially resolved model concurrently with the actual process being performed and in a time frame shorter in time than the actual process being performed by:

using code parallelization techniques on multiple simulation modules in the device manufacturing fab, and

re-using known simulation solutions as initial conditions for the first principles simulation,

wherein re-using known simulation solutions comprises searching in the fab-level library for a closest fitting solution which if used for the initial condition would reduce the number of iterations required by the simulation module;

providing from the solution of the computer-encoded differential equations solved concurrently with the actual process being performed a first principles simulation result; and

using the virtual sensor measurement obtained during the performance of the actual process to facilitate the actual process being performed by the semiconductor processing tool.

Claim 2 (Previously Presented): The method of Claim 1, wherein said inputting process data comprises directly inputting the data relating to the actual process being

performed by the semiconductor processing tool from at least one of a physical sensor and a metrology tool physically mounted on the semiconductor processing tool.

Claim 3 (Previously Presented): The method of Claim 1, wherein said inputting process data comprises indirectly inputting the data relating to the actual process being performed by the semiconductor processing tool from at least one of a manual input device and a database.

Claim 4 (Original): The method of Claim 3, wherein said indirectly inputting comprises inputting data recorded from a process previously performed by the semiconductor processing tool.

Claim 5 (Original): The method of Claim 3, wherein said indirectly inputting comprises inputting data set by a simulation operator.

Claim 6 (Previously Presented): The method of Claim 1, wherein said inputting process data comprises inputting data relating to at least one of the physical characteristics of the semiconductor processing tool and the semiconductor tool environment.

Claim 7 (Previously Presented): The method of Claim 1, wherein said inputting process data comprises inputting data relating to at least one of a characteristic and a result of a process performed by the semiconductor processing tool.

Claims 8-9 (Canceled).

Claim 10 (Original): The method of Claim 1, wherein said performing first principles simulation comprises performing first principles simulation concurrently with the process performed by the semiconductor processing tool.

Claim 11 (Original): The method of Claim 10, further comprising:

repeatedly updating the data from the physical sensor or metrology tool during the semiconductor process;

repeatedly performing the first principles simulation using the updated data during the semiconductor process;

facilitating the semiconductor process concurrently with running the semiconductor process based on virtual sensor measurements obtained during the semiconductor process.

Claim 12 (Original): The method of Claim 10, further comprising:

setting boundary conditions for the first principles simulation prior to a start of the semiconductor process;

performing a time dependent simulation of the semiconductor process during the semiconductor process and without direct input from the semiconductor process; and

facilitating the semiconductor process concurrently with running the semiconductor process based on virtual sensor measurements obtained during the semiconductor process.

Claim 13 (Previously Presented): The method of Claim 1, further comprising performing first principles simulation not concurrently with the process performed by the semiconductor processing tool.

Claim 14 (Canceled).

Claim 15 (Original): The method of Claim 3, wherein said indirectly inputting comprises inputting best known input parameters for the physical model.

Claim 16 (Original): The method of Claim 15, further comprising:

comparing said virtual sensor measurements with actual sensor measurements; and

refining at least one of the best known input parameters and the physical model to obtain better agreement between the virtual sensor measurements with actual sensor measurements.

Claim 17 (Original): The method of Claim 1, wherein said using the virtual sensor measurement comprises using the virtual sensor measurement to characterize the process performed by the semiconductor processing tool.

Claim 18 (Original): The method of Claim 1, wherein said using the virtual sensor measurement comprises using the virtual sensor measurement to control the process performed by the semiconductor processing tool.

Claim 19 (Original): The method of Claim 1, wherein said using the virtual sensor measurement comprises using the virtual sensor measurement to detect a fault in the process performed by the semiconductor processing tool.

Claim 20 (Original): The method of Claim 1, further comprising storing the virtual sensor measurement in a library for subsequent use in a first principles simulation.

Claim 21 (Previously Presented): The method of Claim 1, further comprising using a network of interconnected resources inside a semiconductor device manufacturing facility to perform the first principles simulation recited in Claim 1.

Claim 22 (Original): The method of Claim 21, further comprising using code parallelization among interconnected computational resources to share the computational load of the first principles simulation.

Claim 23 (Original): The method of Claim 21, further comprising sharing simulation information among interconnected resources to facilitate a process performed by the semiconductor processing tool.

Claim 24 (Original): The method of Claim 23, wherein said sharing simulation information comprises distributing simulation results among the interconnected resources to reduce redundant execution of substantially similar first principles simulations by different resources.

Claim 25 (Original): The method of Claim 23, wherein said sharing simulation information comprises distributing model changes among the interconnected resources to reduce redundant refinements of first principles simulations by different resources.

Claim 26 (Previously Presented): The method of Claim 1, further comprising using remote resources via a wide area network to facilitate the semiconductor process performed by the semiconductor processing tool.

Claim 27 (Original): The method of Claim 26, wherein said using remote resources comprises using at least one of remote computational and storage resources via a wide area network to facilitate the semiconductor process performed by the semiconductor processing tool.

Claim 28 (Currently Amended): A system comprising:

a semiconductor processing tool configured to perform a process;

~~an input device configured to input data relating to an actual process being performed by the semiconductor processing tool; and~~

~~a first principles simulation processor configured to:~~

~~input a first principles physical model including a set of computer-encoded differential equations describing at least one of a basic physical or chemical attribute of the semiconductor processing tool, and~~

~~perform first principles simulation for the actual process being performed during performance of the actual process using the physical model to provide a first principles simulation result in accordance with the process data relating to the actual process being performed in order to simulate the actual process being performed~~

a fab-level library storing known simulation results obtained from simulation modules in a device manufacturing fab;

a fab-level process controller distributing the known simulation results to other semiconductor processing tools in the device manufacturing fab;

a first principles simulation processor configured to input a first principles physical model including a set of computer-encoded differential equations describing at least one of a basic physical or chemical attribute the semiconductor processing tool and including 1) a spatially resolved model of a physical geometry of the semiconductor processing tool and 2)

a grid set addressing the semiconductor processing tool or a geometry of the semiconductor processing tool;

an input device configured to input process data related to an actual process being performed by the semiconductor processing tool; and

said first principles simulation processor further configured to:

set boundary conditions for the spatially resolved model of a physical geometry of the semiconductor processing tool based on said process data related to the actual process being performed by the semiconductor processing tool,

solve the computer-encoded differential equations of the first principles physical model for the spatially resolved model concurrently with the actual process being performed and in a time frame shorter in time than the actual process being performed by:

using code parallelization techniques on multiple simulation modules in the device manufacturing fab, and

re-using known simulation solutions as initial conditions for the first principles simulation,

wherein re-using known simulation solutions comprises searching in the fab-level library for a closest fitting solution which if used for the initial condition would reduce the number of iterations required by the simulation module,

provide from the solution of the computer-encoded differential equations solved concurrently with the actual process being performed a first principles simulation result to provide a virtual sensor measurement relating to the actual process being performed by the semiconductor processing tool,

wherein the virtual sensor measurement obtained during the performance of the actual process is used to facilitate the actual process being performed by the semiconductor

processing tool~~, said first principles simulation result being produced in a time frame shorter in time than the actual process being performed~~.

Claim 29 (Original): The system of Claim 28, wherein said input device comprises at least one of a physical sensor and a metrology tool physically mounted on the semiconductor processing tool.

Claim 30 (Original): The system of Claim 28, wherein said input device comprises at least one of a manual input device and a database.

Claim 31 (Original): The system of Claim 30, wherein said input device is configured to input data recorded from a process previously performed by the semiconductor processing tool.

Claim 32 (Original): The system of Claim 30, wherein said input device is configured to input data set by a simulation operator.

Claim 33 (Original): The system of Claim 28, wherein said input device is configured to input data relating to at least one of the physical characteristics of the semiconductor processing tool and the semiconductor tool environment.

Claim 34 (Original): The system of Claim 28, wherein said input device is configured to input data relating to at least one of a characteristic and a result of a process performed by the semiconductor processing tool.

Claims 35-36 (Canceled).

Claim 37 (Original): The system of Claim 28, wherein said processor is configured to perform said first principles simulation concurrently with the process performed by the semiconductor processing tool.

Claim 38 (Original): The system of Claim 37, wherein said processor is further configured to:

repeatedly update the data from the physical sensor or metrology tool during the semiconductor process; and

repeatedly perform the first principles simulation using the updated data during the semiconductor process, wherein the semiconductor process is facilitated concurrently with running the semiconductor process based on virtual sensor measurements obtained during the semiconductor process.

Claim 39 (Original): The system of Claim 37, wherein said processor is further configured to:

set boundary conditions for the first principles simulation prior to a start of the semiconductor process; and

perform a time dependent simulation of the semiconductor process during the semiconductor process and without direct input from the semiconductor process, wherein the semiconductor process is facilitated concurrently with running the semiconductor process based on virtual sensor measurements obtained during the semiconductor process.

Claim 40 (Original): The system of Claim 28, wherein said processor is configured to perform said first principles simulation not concurrently with the process performed by the semiconductor processing tool.

Claim 41 (Original): The system of Claim 40, wherein said processor is configured to perform said first principles simulation at least by using the input data to set at least one of initial and boundary conditions of said first principles simulation recorded from a process previously performed.

Claim 42 (Original): The system of Claim 30, wherein said input device is configured to input best known input parameters for the physical model.

Claim 43 (Original): The system of Claim 42, wherein said processor is configured to:

compare said virtual sensor measurements with actual sensor measurements; and

refine at least one of the best known input parameters and the physical model to obtain better agreement between the virtual sensor measurements with actual sensor measurements.

Claim 44 (Original): The system of Claim 28, wherein said virtual sensor measurement is used to characterize the process performed by the semiconductor processing tool.

Claim 45 (Original): The system of Claim 28, wherein said virtual sensor measurement is used to control the process performed by the semiconductor processing tool.

Claim 46 (Original): The system of Claim 28, wherein said virtual sensor measurement to is used detect a fault in the process performed by the semiconductor processing tool.

Claim 47 (Original): The system of Claim 28, wherein said processor is further configured to store the virtual sensor measurement in a library for subsequent use in a first principles simulation.

Claim 48 (Previously Presented): The system of Claim 28, further comprising a network of interconnected resources inside a semiconductor device manufacturing facility and connected to said processor and configured to assist said processor in performing at least one of the inputting a first principles simulation model and performing a first principles simulation.

Claim 49 (Original): The system of Claim 48, wherein said network of interconnected resources is configured to use code parallelization with said processor to share the computational load of the first principles simulation.

Claim 50 (Original): The system of Claim 48, wherein said network of interconnected resources is configured to share simulation information with said processor to facilitate said process performed by the semiconductor processing tool.

Claim 51 (Original): The system of Claim 50, wherein said network of interconnected resources is configured to distribute simulation results to said processor to reduce redundant execution of substantially similar first principles simulations.

Claim 52 (Original): The system of Claim 50, wherein said network of interconnected resources is configured to distribute model changes to said processor to reduce redundant refinements of first principles simulations.

Claim 53 (Previously Presented): The system of Claim 28, further comprising remote resources connected to said processor via a wide area network and configured to facilitate the semiconductor process performed by the semiconductor processing tool.

Claim 54 (Original): The system of Claim 53, wherein said remote resources comprise at least one of a computational and a storage resource.

Claims 55 - 61 (Cancelled)

Claim 62 (Currently Amended): At least one of non-volatile media and volatile media encoded with a computer program containing program instructions for execution on a processor, which when executed by the computer system, cause the processor to perform the steps of:

~~inputting process data relating to an actual process being performed by the semiconductor processing tool;~~

~~inputting a first-principles physical model including a set of computer-encoded differential equations, the first-principles physical model describing at least one of a basic physical or chemical attribute of the semiconductor processing tool;~~

~~performing first-principles simulation for the actual process being performed during performance of the actual process using the physical model to provide a first-principles simulation result in accordance with the process data relating to the actual process being performed in order to simulate the actual process being performed, said first-principles simulation result being produced in a time frame shorter in time than the actual process being performed;~~

inputting a first principles physical model including a set of computer-encoded differential equations, the first principles physical model describing at least one of a basic physical or chemical attribute of the semiconductor processing tool and including 1) a spatially resolved model of a physical geometry of the semiconductor processing tool and 2) a grid set addressing the semiconductor processing tool or a geometry of the semiconductor processing tool;

inputting process data related to an actual process being performed by the semiconductor processing tool;

setting boundary conditions for the spatially resolved model of a physical geometry of the semiconductor processing tool based on said process data related to the actual process being performed by the semiconductor processing tool;

storing in a fab-level library known simulation results obtained from simulation modules in a device manufacturing fab and distributing the known simulation results to other semiconductor processing tools in the device manufacturing fab;

solving the computer-encoded differential equations of the first principles physical model for the spatially resolved model concurrently with the actual process being performed and in a time frame shorter in time than the actual process being performed by:

using code parallelization techniques on multiple simulation modules in the device manufacturing fab, and

re-using known simulation solutions as initial conditions for the first principles simulation,

wherein re-using known simulation solutions comprises searching in the fab-level library for a closest fitting solution which if used for the initial condition would reduce the number of iterations required by the simulation module;

providing from the solution of the computer-encoded differential equations solved concurrently with the actual process being performed a first principles simulation result; and

using the virtual sensor measurement obtained during the performance of the actual process to facilitate the actual process being performed by the semiconductor processing tool.

Claims 63-65 (Canceled).